




STAB Kickoff August 8, 2000 Boeing Phantom Works

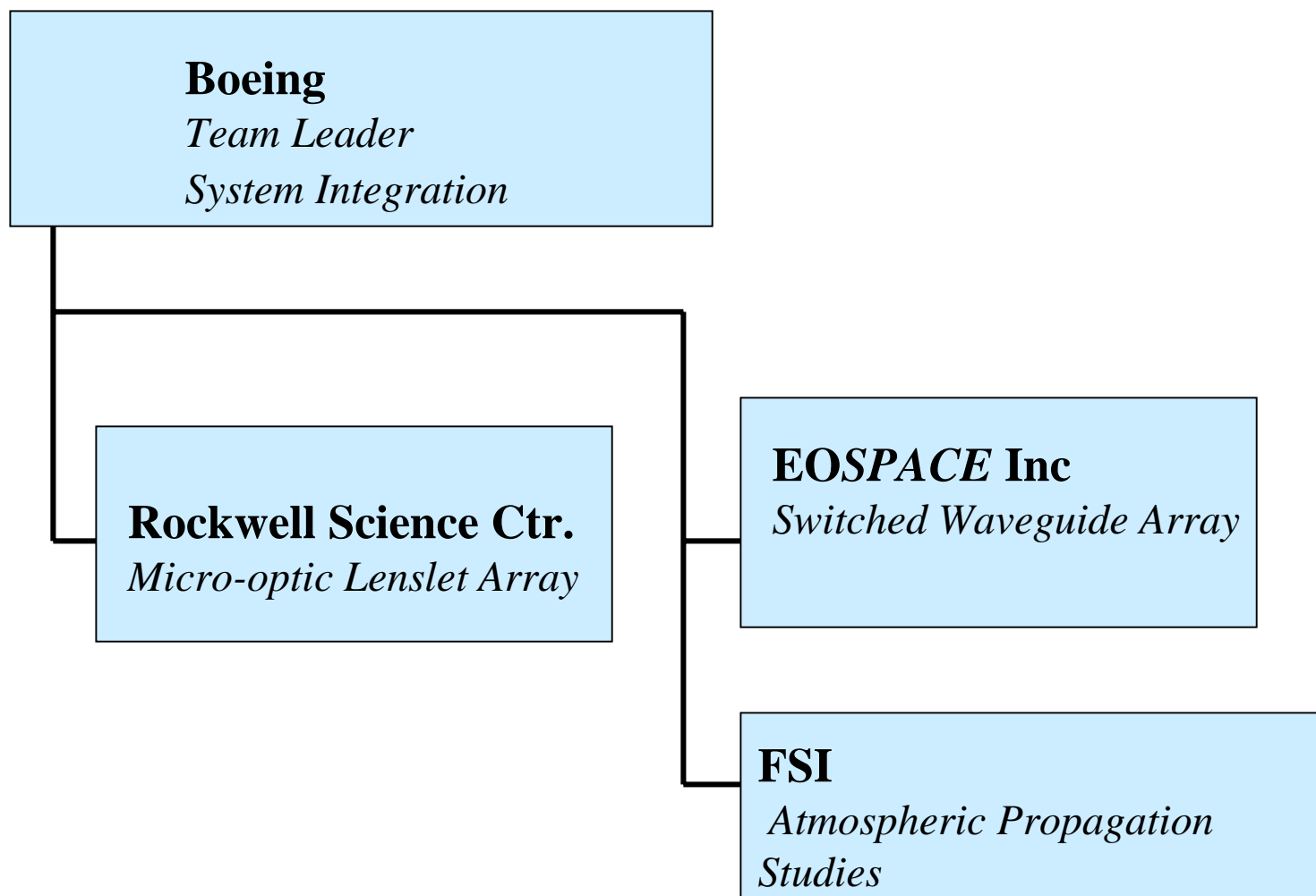
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Barbara Capron P.I.

PHANTOM WORKS

Boeing Integration
Capabilities Enabling
Steered Agile Beam EO Solutions
for the
Theater WarFighter

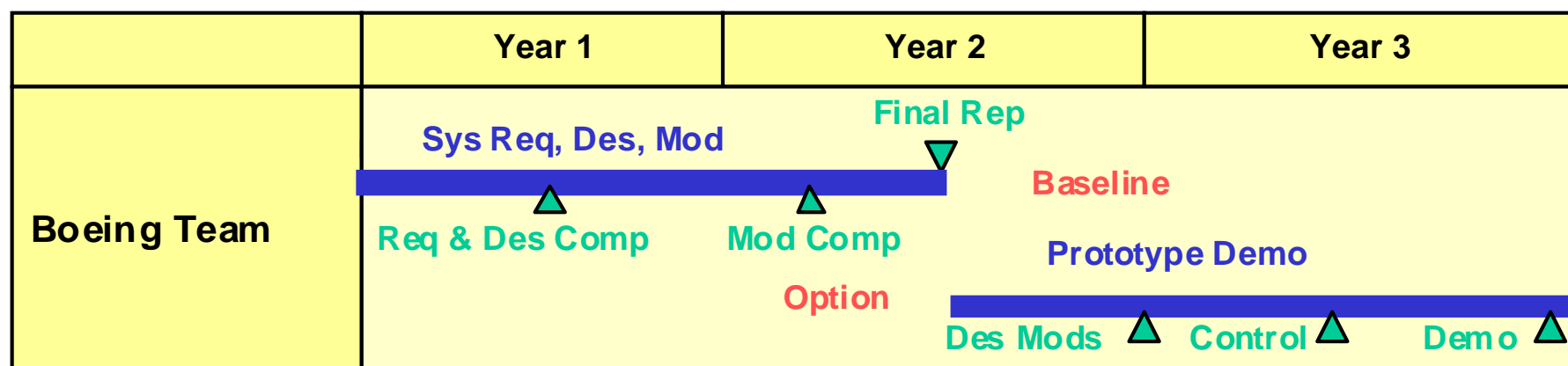
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- **STAB Technologies**
 - MEMS, SLM, OPA, XOD, Micro-Optic
 - **Steering angles**
 - $\pm 2^\circ$ to $\pm 45^\circ$
 - **Control Loop Bandwidths**
 - 10 Hz to 10 kHz
 - **Boeing Experience**
 - Laser Range/Designation
 - IRCM
 - LOS Stabilization
 - MEMS
 - Optical Phased Arrays (OPA)
 - Adaptive Optics
 - Optical Communications

Boeing STAB Team Organization





Schedule for Boeing-Team STAB Program



DARPA - Steered Agile Beam Program - STAB

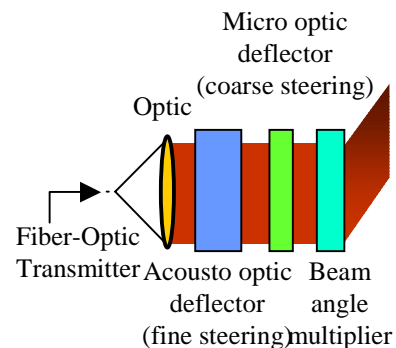
Candidate Approaches

PHANTOM WORKS

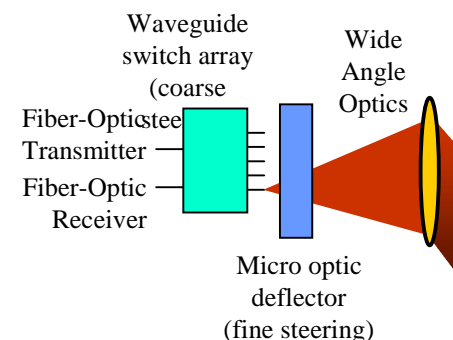
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- **Solid State Agile Beam Steering**

- Develop prototype solid state beam steering device for hand held multi-point laser communications package with high speed tracking, multiple beam pointing and tracking.
- Boeing (prime), RSC EOSPACE, FSI
- \$3M(\$1M base, \$2M option), 3 Years



a) Optical Phased Array



b) Switched Emitter Array

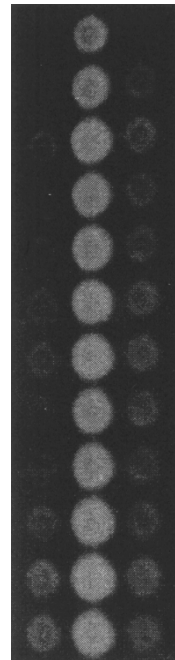
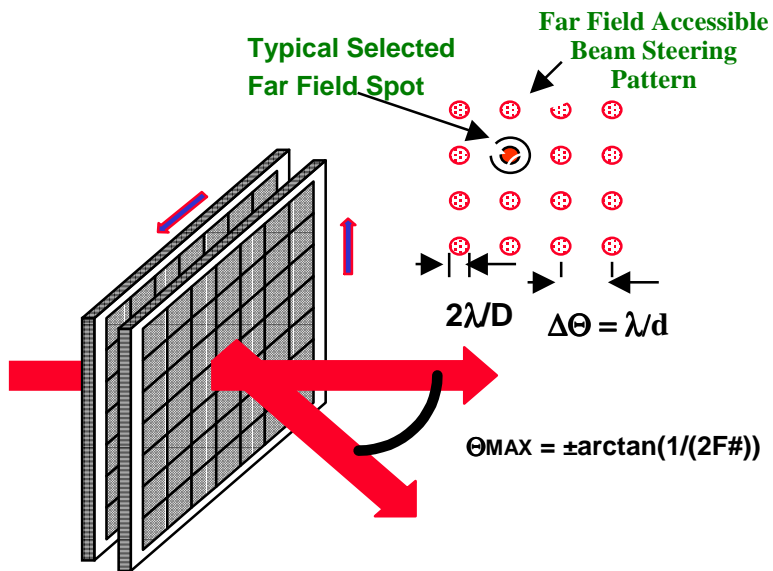
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Rockwell Science Center's Micro-optic (M-O) Beam Steering Module

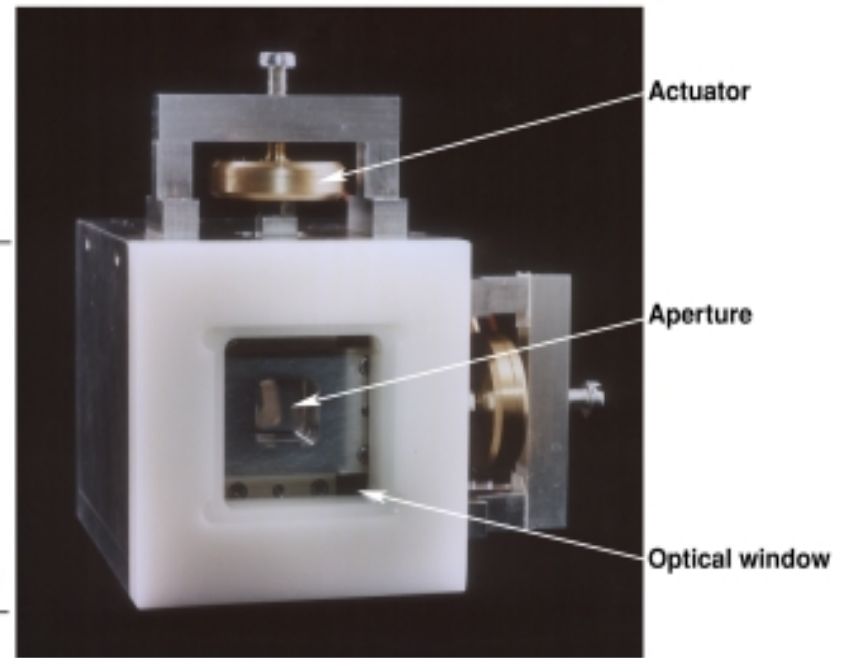
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Micro-Optic Beam Steering

- Requires only micro-motion of micro-optics



Linear scan demo



2-dimension steering with piezo actuators

- Relative motion of the M-O arrays in X and Y steers beam in 2-D
- Large angle steering requires fast (low F#) micro-lenses
- M-O lens arrays with F# 0.5 have been demonstrated at RSC

RSC MOEM (Micro-Opto-ElectroMechanical) Beam Steering

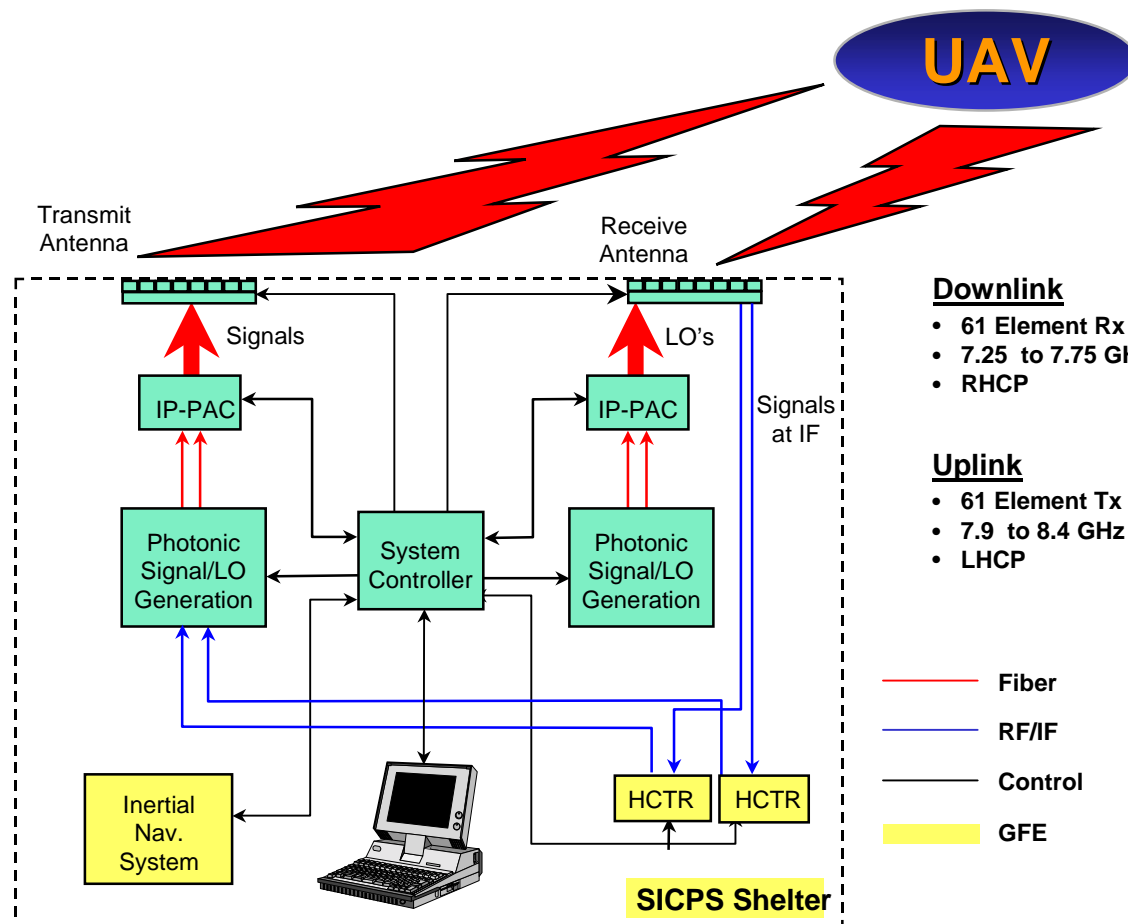


- Based on optical MEMS technology
 - Lightweight, low power, compact
 - Low cost
- Surface flatness of MEM scanner a crucial RSC development
- Numerous dual use applications (barcode scanners, low resolution HMD, perimeter sensors, etc.)
- Demonstrated concept at RSC

Boeing brings experience to bear in optical phase control

Optical Control of RF Phase - System Overview

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Downlink

- 61 Element Rx
- 7.25 to 7.75 GHz
- RHCP

Uplink

- 61 Element Tx
- 7.9 to 8.4 GHz
- LHCP

Darpa Steered Agile Beam Program Armored Platforms

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Avenger Missile System



Bradley Lindbacker



Darpa Steered Agile Beam Program Missile Platforms

PHANTOM WORKS

BOEING®

AGM-130



PAC-3



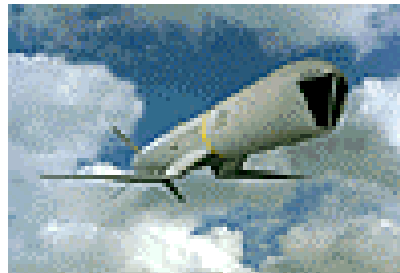
JDAM



GBU-15



SLAM-ER



SLID



Harpoon

Brimstone



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Boeing STAB open Kickoff 8/9/00

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Boeing understands the value of reducing size and weight of optical subsystems

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- **Directed Infrared Countermeasures (DIRCM)** is a self-protection suite that includes a missile warning sensor that detects missile launches, and assesses the threat; a turret with the Fine Track Sensor for tracking, and high-intensity infrared flash lamps for defeat of the threat missile's seeker, with control HW and S/W. The DIRCM suite is designed for future upgrade to a laser-based defeat mechanism that will be effective against future threats.



MMS uses a combination of a high-resolution television camera, thermal imaging sensors and a laser rangefinder/designator to accomplish its mission. The imaging sensor package provides detection and recognition at night and in inclement weather, while the laser rangefinder/designator achieves precise target designation for laser-guided weapons.